



Impact of technology and regional specific discount rates

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Impact of technology and regional specific discount rates

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EFDA-TIMES and EFDA-TIAM Workshop

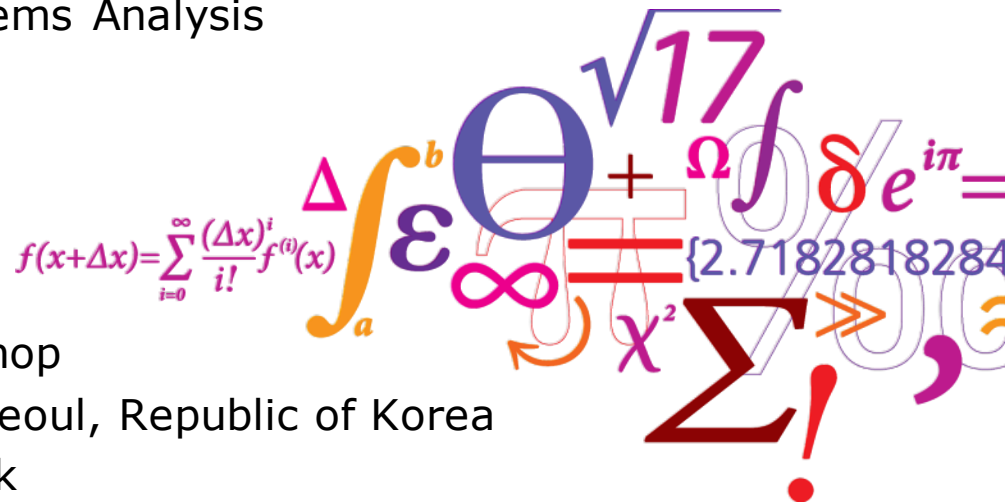
64th Semi-annual ETSAP meeting, Seoul, Republic of Korea

Video link to DTU, Roskilde, Denmark

4 November 2013

DTU Management Engineering

Department of Management Engineering



Overview

- Discounting in optimisation models
- Discounting and other economic parameters in TIMES models
- Genesis of EFDA-TIMES and TIAM
- Results explained by sensitivity analyses
- Conclusion: Impact of results for electricity generation mix

The discounting issue

- Ethical, or prescriptive, approach
 - social rate of time discount
 - sum of the rate of pure time-preference and the rate of increase of welfare
- Descriptive approach
 - rates of discount people (savers as well as investors) actually apply in their day-to-day decisions;
 - the market rate of return to investments

Source: IPCC Second Assessment Report, 1995;

Discount factors

		Number of periods					
Discount rate		1	5	10	20	50	100
	0	1.00	1.00	1.00	1.00	1.00	1.00
	1	0.99	0.95	0.91	0.82	0.61	0.37
	2	0.98	0.91	0.82	0.67	0.37	0.14
	5	0.95	0.78	0.61	0.38	0.09	0.01
	10	0.91	0.62	0.39	0.15	0.01	0.00
	15	0.87	0.50	0.25	0.06	0.00	0.00

Social rate of time preference (SRPT)

Weitzmann step decline schedule

Period, years	Discount rate, %
0-5	4
6-25	3
26-75	2
76-300	1

Weitzman M.- (1998), Why the far distant future should be discounted at its lowest possible rate, Journal of environmental.

IPCC Third Assessment Report, 2001

Hurdle rates

- EFDA-TIMES and TIAM: overall discount rate 5 %
- Hurdle rates - technologies special “discount rates”.
 - rates of discount people (savers as well as investors) actually apply in their day-to-day decisions;
 - the market rate of return to investments

Source: IPCC Second Assessment Report, 1995;

History of sectoral discount rates

Sector or service	Range (%)	Source
Industrial		
Process	20 - 50	Hassett and Metcalf 1993
Discretionary	>50	DeCanio 1993
Residential		
Shell heating	7 - 21	Lin et al. 1976
	>36	Goett 1978
	6.5 - 16	Goett and McFadden 1982
	4.4 - 36	Reported in Train 1985 [‡]
	26 - 79*	Hartman and Doane 1986
Shell conservation retrofit	15 - 35	Cole and Fuller 1980
	6 - 34	Corum and O'Neal 1982
	>32	A.D. Little 1984
	10 - 32	Reported in Train 1985 [‡]
	52 - 98	Hartman and Doane 1986
Refrigerators	61 - 108	Cole and Fuller 1980
	45 - >100	Gately 1980
	34 - 58	Meier and Whittier 1983
Appliances	34 - 108	Reported in Train 1985 [‡]
	18 - 31	Lin et al. 1976
	24	Dubin 1982
	67	Goett and McFadden 1982
	30 - 70	Reported in Train 1985 [‡]
Commercial		
Shell/HVAC	30 - 50	Lohani and Azini 1992

* For middle income, middle aged groups.

[‡] Train 1995 provides a summary of literature on discount rates for residential and automobile use

Genesis of EFDA-TIMES and TIAM

MARKAL/TIMES Global models

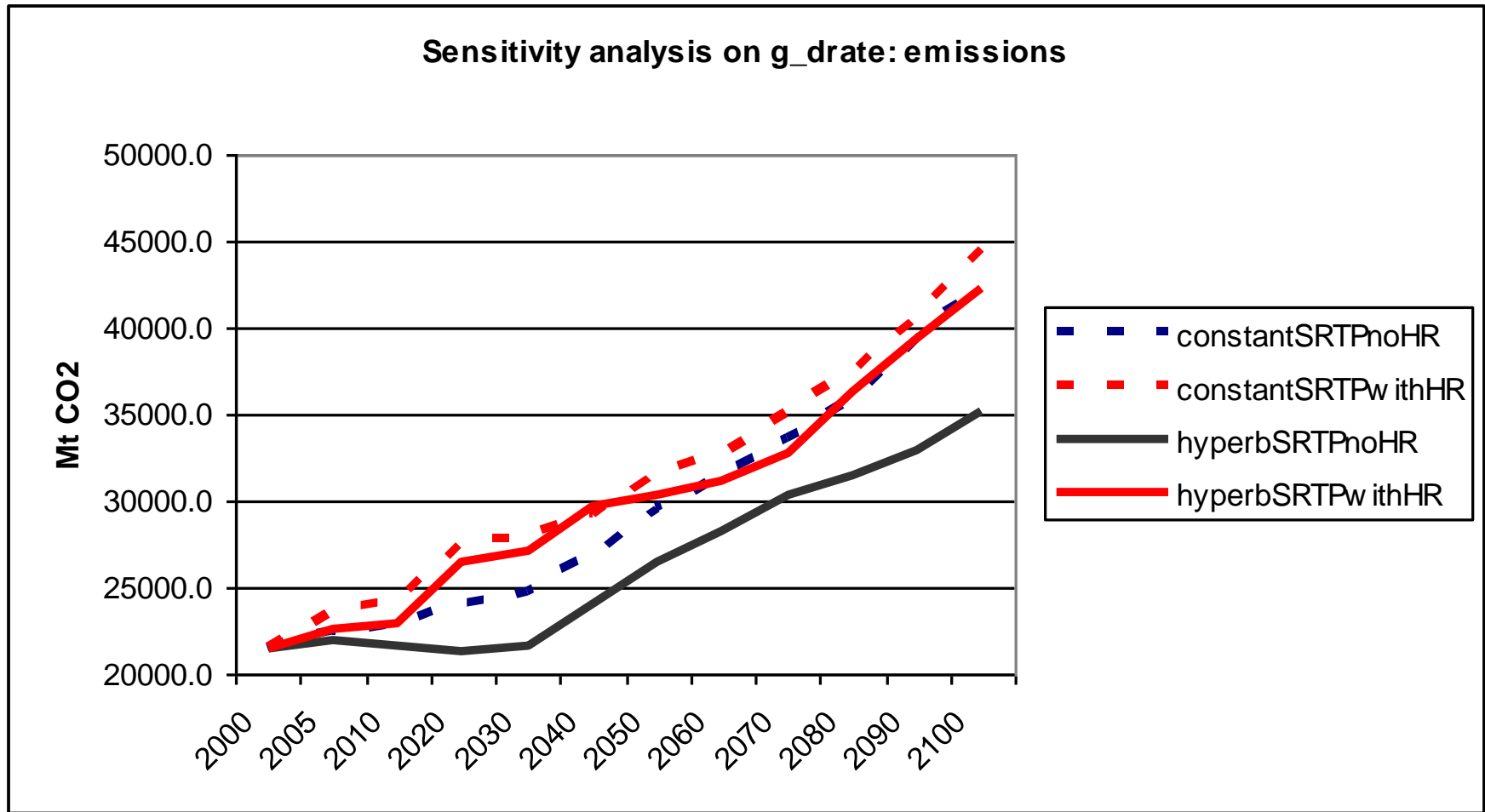
- Initial proposal by Amit Kanudia & Richard Loulou to ETSAP at ETSAP meeting in 1998
- SAGE at USDOE-EIA: 2000-2003 and on: Global, myopic MARKAL
- IEA-ETP project: 2001-2003 and on: global MARKAL with focus on technology, environmental issues
- EFDA: 2004 and on: First global TIMES model: focus on technology, environment, very long term (2100)
- ETSAP's TIAM: 2004-2006: elaborated from previous modeling experience. Focus on technology, energy trade, link with macroeconomy (GEM-E3), global environmental issues (GHG, climate module), very long term (2100)

From presentation by Richard Loulou, ETSAP workshop, Stuttgart, November 2006

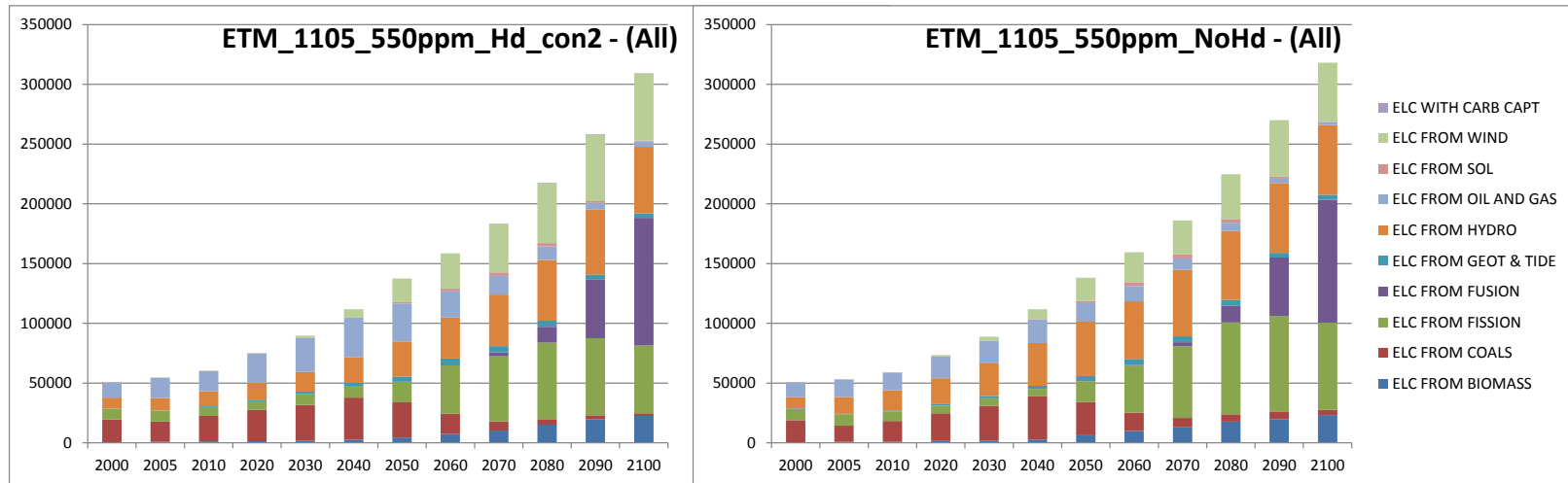
Discounting, regional-specific parameters and lead times in EFDA-TIMES and ETSAP-TIAM

- General discount rate 5% p.a., however
- Hurdle rate 10 % for large-scale electricity generating technologies.
- Larger hurdle rates – e.g. 17.5 % for small-scale technologies
- Regional specific hurdle rates and cost parameters and hurdle rates – industrial countries more efficient than developing countries
- Lead times in TIAM:
 - Sensitivity analyses for discounting and lead times
 - Simple solution needed for basic scenarios

Sensitivity of Social rate of time preference (SRPT)



Impact of hurdle rates: Example of results and conclusion



The left graph shows the base case of EFDA-TIMES 2011 version with consistent hurdle rates from, the right graph shows the same results without hurdle rates.

This example illustrates the general conclusion that most model results are fairly robust to changes in discount and hurdle rates, *provided that hurdle rates are consistent among technologies.*

References

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